Non-destructive Faraday imaging of dynamically controlled ultracold atoms

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We introduce an easily implementable method for non-destructive measurements of ultracold atomic clouds based on dark field imaging of spatially resolved Faraday rotation. The dependence on laser detuning, atomic density and temperature is characterized in a detailed comparison with theory. Due to low destructiveness, the same cloud can be imaged up to 2000 times. The technique is applied to avoid the effect of shot-to-shot fluctuations in atom number calibration, to demonstrate single-run vector magnetic field imaging and single-run spatial imaging of the system's dynamic behavior. This paves the way towards quantum state engineering using feedback control of ultracold atoms [1].

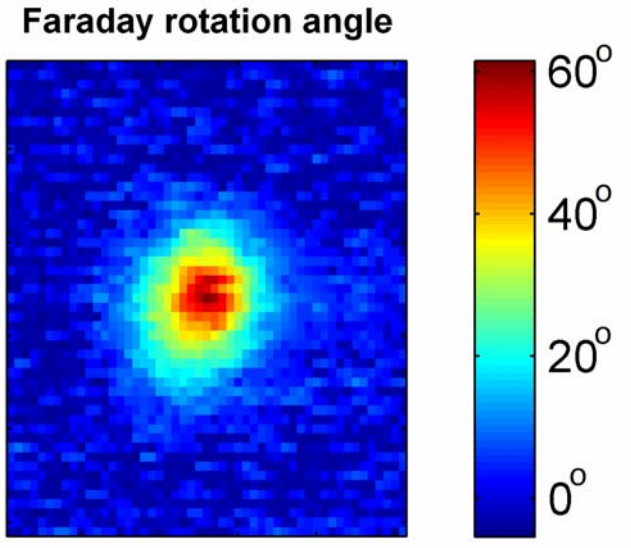

Fig.1: A non-destructive Faraday image of an ultracold atomic cloud.

References:
[1] M, Gajdacz, P. L. Pedersen, T. Mørch, A. J. Hilliard, J. Arlt and J. F. Sherson; *Non-destructive Faraday imaging of dynamically controlled ultracold atoms;* arXiv:1301.3018